APPLICATION

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TITLE: TOOTHBRUSHES

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TOOTHBRUSHES

TECHNICAL FIELD

This invention relates to toothbrushes, and more particularly to power toothbrushes.

BACKGROUND

Power toothbrushes are well known and have been on the market for years. In typical power toothbrushes, tufts of bristles on the brush head extend generally perpendicularly from the top surface of the head. The head is oscillated, rotated and/or translated in order to provide enhanced tooth cleaning capability.

In many power toothbrushes, the top surface of the head is generally circular in shape, and is dimensioned to clean the larger teeth one at a time and smaller teeth two at a time, with most of the bristles typically contacting the tooth or teeth during brushing. In some power toothbrushes, the head has a generally oval shape.

SUMMARY

In general, the invention features power toothbrush heads having particular arrangements of bristles and/or tufts of bristles, power toothbrushes including such heads, and methods of using such heads and toothbrushes.

In one aspect, the invention features a head for a power toothbrush including an elongated support member, and a plurality of bristles extending from the support member, at least some of the bristles having different heights, the bristles being arranged so that their heights are symmetric, in a non-translatable mirror image symmetry, about two planes of symmetry.

In another aspect, the invention features a head for a power toothbrush including an elongated support member, and a plurality of tufts of bristles extending from the support member, the tufts of bristles having at least three different heights, the tufts being arranged so that their tips define a rounded contour.

Some implementations of these aspects include one or more of the following features. The bristles or tufts have may different lengths, measured from a top surface of the support member. Alternatively, or in addition, the bristles or tufts may extend the same length from a top surface of the support member, and the top surface is contoured so that the bristles or tufts have

different heights as measured from a horizontal plane taken through the lowest point on the top surface. The two planes of symmetry may be arranged about a central axis of the brush head. The bristles may be arranged in an array and tips of the bristles define a continuously curved surface. The two planes of symmetry may intersect in the vicinity of the center of the elliptical support member. The head may be configured for use on a power toothbrush having a rotationally oscillating motion. The tufts of bristles may have at least four different heights. The rounded contour may be lowest adjacent a pivot point of the head. A top surface of the support member may have an overall surface area of from about 170 to 200 mm^2. The head may further include one or more elastomeric element(s). The tufts may be arranged so that their heights are symmetric about two planes of symmetry. The height of the tallest bristles may be from about 20 to 50% greater than the height of the shortest bristles. A top surface of the support member may have a length of about 14 to 19 mm, e.g., about 16 to 17 mm. The top surface may have a width of about 12 to 15 mm, e.g., about 13 to 14 mm. The top surface may have an aspect ratio (length/width) of about 1.2 to 1. The top surface may have a shape selected from the group consisting of oval, ellipse, rounded diamond, and rounded rectangle. The top surface may have a concave shape.

In a further aspect, the invention features a power toothbrush including a handle, and, extending from the handle, a head including an elongated support member, and a plurality of bristles extending from the support member, at least some of the bristles having different heights, the bristles being arranged so that their heights are symmetric, in a non-translatable mirror image symmetry, about two planes of symmetry.

In yet another aspect, the invention features a power toothbrush including a handle, and, extending from the handle, a head including an elongated support member, and a plurality of tufts of bristles extending from the support member, the tufts of bristles having at least three different heights, the tufts being arranged so that their tips define a rounded contour.

Some implementations of these aspects may include one or more of the features discussed above.

The invention also features, in another aspect, a head for a power toothbrush including an elongated support member, and a plurality of bristles extending from the support member, at least some of the bristles having different heights, the heights of the bristles being selected to

provide a bristle tip contour that allows substantially all of the bristle tips to contact the dentition simultaneously during brushing.

In another aspect, the invention features methods of brushing teeth including contacting the teeth with bristles of one of the power toothbrushes discussed above.

In some implementations, the contour of the bristles or bristle tufts allows all or substantially all of the bristle tips to contact the dentition (tooth surface) when the toothbrush head is brushing one or more teeth of a user. Whether this occurs in a given implementation may be determined, e.g., by high speed videography. In some cases, the support surface from which the bristles extend is generally elongated, and the contour allows all of the bristle tips, including those at the distal ends of the head, to contact the dentition. As a result, a longer surface may be cleaned simultaneously, as compared to a flat brush having the same area or shape as projected onto a flat plane. Such brush heads also generally feel comfortable in the mouth, and do not seem overly bulky. A toothbrush that is contoured to match the general curvature of the dentition also holds the support surface at a more consistent position (i.e. height and angle) above the teeth. This allows taller cleaning elements to be incorporated into the toothbrush that are spaced appropriately to reach in between the teeth and other areas that are normally difficult to access.

The details of one or more embodiments of the invention are set forth in the accompanying drawings and the description below. Other features and advantages of the invention will be apparent from the description and drawings, and from the claims.

DESCRIPTION OF DRAWINGS

FIG. 1 is a perspective view of a brush head according to one embodiment of the invention.

FIG. 1A is a side view of the brush head of Fig. 1.

FIG. 1B is a transverse cut-away view of the brush head of Fig. 1.

FIG. 1C is a perspective view of a brush head similar to that shown in Fig. 1, except that the head is slightly tilted towards the handle, with planes of symmetry indicated.

FIG. 1D is a side view of the brush head of Fig. 1C, with planes of symmetry indicated.

FIG. 2 is a perspective view of a brush head according to an alternative embodiment.

FIG. 3 is a perspective view of a brush head according to another alternative embodiment.

FIG. 3A is a side view of the brush head of FIG. 3.

FIG. 3B shows the brush of FIG. 3 with a portion of the brush head cut away to show the pivoting mechanism.

FIG. 4 is a transverse cut-away view of a brush head according to another alternative embodiment.

DETAILED DESCRIPTION

Referring to Fig. 1, a power toothbrush 10 includes a head 12 and a neck 14. As is well known to those skilled in the art, head 12 is oscillated during brushing. Generally, the head 12 is oscillated in a rotating manner about an axis of rotation which typically extends through the center of the head but may be offset, as will be discussed below. An electric motor (not shown) oscillates the head through gearing, linkages, cranks, and/or other drive mechanisms as is well known. Electrical power may be supplied to the motor by rechargeable or primary (disposable) batteries. Further details as to how the head is oscillated will not be provided, as this aspect of the brush is not the focus of the invention.

Head 12 includes a generally elliptical support member 16 that is disposed approximately perpendicular to the axis of rotation of the head, and, extending from a top surface 17 of the support member 16, a plurality of bristle tufts 18. As will be discussed below, the top surface 17 typically is perpendicular to the axis of rotation, but may in some cases be tilted so that it is not perpendicular to the axis of rotation.

Although each tuft 18 is shown as a solid mass in the drawings, the tufts may each be made up of a great number of individual plastic bristles. The bristles may be made of any desired polymer, e.g., nylon 6.12 or 6.10, and may have any desired diameter, e.g., 4 to 8 mil. The tufts are supported at their bases by the support member, and may be held in place by any desired tufting technique as is well known in the art, e.g., by insert molding or a stapling process. The tufts may also be mounted to move on the support member, e.g., with a pivoting motion as will be discussed below with reference to Figs. 2 and 3-3B.

The support member is generally elliptical, i.e., it has a long axis and a short axis. Preferably, the long axis has a length of about 14 to 19 mm, and the short axis has a length of about 12 to 15 mm. The ellipse may have an aspect ratio (long axis/short axis) of about 1.2 to 1. The head size is most preferably around 16 to 17 mm long by 13 to 14 mm wide. The overall

surface area of the surface 17 of the support member is preferably about 170 to 200 mm^2 (0.270 to 0.305 sq in).

There is a height differential between the different bristle tufts. The curved, elongated interdental tufts 18A, i.e., the two tufts that are at each furthest edge of the support member, adjacent the long axis of the toothbrush neck 14 when the head 12 is at rest, are tallest. The round end tufts 18B that are immediately inboard of the interdental tufts 18A (three on each side) are the next tallest, followed by the side tufts 18D (three on each side), which are mounted along the edge of the support member between the two sets of round end tufts 18B. The shortest tufts are the inner tufts 18C, which are arranged in a ring of five tufts, inboard of the side and end tufts. The interdental tufts 18A may be, for example, about 20 to 50% taller than the inner tufts 18C, e.g., from about 7 to 8.5 mm in height, the end tufts 18B may be about 10 to 40% taller than the inner tufts 18C, e.g., about 6 to 8 mm in height, and the side tufts 18D may be, for example, about 0 to 25% taller than the inner tufts 18C, e.g., from about 5 to 7 mm in height.

The contour produced by this height differential between the bristle tufts allows the tips of the bristles to conform closely to the shape of the dentition, allowing most or all of the bristles to contact the dentition during brushing of multiple teeth simultaneously. As shown in Fig. 1C, this contour is symmetric about two planes of symmetry, e.g., a plane (P1) taken through the long axis of the elliptical support member and a plane (P2) taken through the short axis of the support member. Both planes are perpendicular to the top surface 17 of the support member. It is noted that the line (L) defined by the intersection of these two planes (shown in Fig. 1D) may or may not be collinear with the axis of rotation (A) of the brush head. In the embodiment shown in Figs. 1C and 1D, the axis of rotation A is perpendicular to a plane (P3) which is not parallel to or coplanar with the plane (P4) of the top surface 17 of the support member. The angle (X) between L and A is the result of the slight tilt of the brush head towards the handle, shown best in Fig. 1D. In other embodiments (e.g., the embodiment shown in Figs. 1-1B), the axis of rotation A is perpendicular to plane P4.

The symmetry of the contour about planes P1 and P2 is a non-translatable mirror image symmetry, i.e., each quadrant is the mirror image of the two adjacent quadrants, but could not be "swapped" with either adjacent quadrant, i.e., "translated," without altering the contour defined by the tufts. Each quadrant can be rotated 180 degrees about the axis of symmetry defined by the intersection of planes P1 and P2 without altering the symmetry of the head, and each quadrant is

a mirror image reflection of the adjacent quadrants. No quadrant can be translated without rotation, without altering the symmetry of the head.

As shown in Fig. 1B, in the embodiment shown in Figs. 1-1B the top surface 17 of support member 16 is generally planar. As a result, the height differential is created by providing tufts of different lengths.

The brush head may include pivoting tufts. For example, brush 50, shown in Fig. 2, includes a head 51 that carries a plurality of fixed tufts 52 and a plurality of pivoting tufts 54. The tufts are arranged to define a contour similar to that described above. Techniques for providing pivoting tufts are described in U.S. Patent No. 6,553,604, the disclosure of which is incorporated by reference herein. One type of pivoting mechanism is shown in Fig. 3B in the context of pivoting elastomeric elements.

The brush head may also include elastomeric elements, in addition to or instead of tufts of bristles. For example, as shown in Figs. 3 and 3A a toothbrush 100 includes elastomeric fins 102 and tufts of bristles 104, arranged to define a contour as discussed above. The elastomeric elements are sized for interproximal insertion, to provide cleaning and massage of the interproximal areas, as described in U.S.S.N. 10/389,448, filed March 14, 2003. In the embodiment shown in Figs. 3-3B the elastomeric fins are pivotably mounted. However, the elastomeric elements may be stationary if desired, and the bristle tufts may be stationary or pivoting.

A number of embodiments of the invention have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of the invention.

For example, while an elliptical support member has been shown and described above, the bristle contour described may be used with support members having other elongated shapes, e.g., oval, rounded diamond, or rounded rectangular.

While, in the embodiments discussed above, the bristle height differential was determined by bristle length, in other embodiments the bristle height differential may be determined based on the geometry of the top surface of the support member. For example, as shown in Fig. 4, a brush head 200 includes a support member 216 having a concave top surface 217. In this embodiment, bristle tufts 218 are all of substantially the same length, but their heights define a contour similar to that described above due to the concave shape of the surface 217.

Moreover, while a brush head having four bristle heights is described above, other numbers of bristle heights may be used. For example, the bristle tufts may have three different heights, or five or more.

Alternatively, the bristles may be arranged in a uniform array, rather than tufts, and the height differential of their tips may define a continuously curved surface, e.g., a cup-shaped surface.

Additionally, while the contour shown in Figs. 1-1A is symmetrical about two planes that intersect in the center of the surface 17 of the support member, symmetry could be defined about a point that is not centered on the support member.

While toothbrush heads having a plurality of elastomeric elements are shown in the figures and described above, some toothbrush heads may include a single elastomeric element. For example, the toothbrush head may include one of the elastomeric elements described in U.S.S.N. 10/364,148, filed February 11, 2003, the disclosure of which is incorporated herein by reference.

Accordingly, other embodiments are within the scope of the following claims.